

Facts about Earthquake Damage to the Delta

There are a number of active faults near the Delta, the San Andreas being the most distant. There is some question as to whether an earthquake on this fault could significantly affect the Delta. (DWR 1992) Certainly, earthquakes on faults closer to the Delta could have serious effects.

There may be a fault passing directly under the Delta, but there is little evidence that this fault is active enough to be of concern. (DWR 1992)

The probability of a major earthquake ¹ on one of these faults (not including the fault beneath the Delta but including the San Andreas Fault) is more than two chances in three sometime within the next 30 years. (USGS 1990, CSUH 1992)

A major earthquake near the Delta could produce ground shaking in the Delta that could cause liquefaction ² of liquefiabilesoils. ³ (DWR 1992)

Much of the Central Delta and portions of the southern Delta are underlain with soils that have a moderate or high potential for liquefaction. (DWR 1992) Some of the soils used for levee construction are also liquefiable. (personal communication, R. Volpe ESA and W. Lettis W. Lettis and Assoc. 1991)

Much of the Delta is also underlain with peaty soils. (DWR 1992) There is uncertainty how peat soils would react in an earthquake. They may serve to attenuate the deep ground shaking, thereby lessening the damaging shaking that occurs near the surface of the ground. In this case, the chances of liquefaction would be lessened. On the other hand, peaty soils may amplify the deep ground shaking. In this case, liquefaction and considerable damage could be expected. ⁴ (ESA 1992)

¹ Magnitude 7.0 or greater. The Loma Prieta earthquake had a magnitude of 7.1.

² Liquefaction means just what it says: some soils that are normally solid can, if shaken, become liquid. You can visualize the phenomenon as follows: Picture sandy soil, saturated with water. That is, the sand particles are resting against each other, but the small spaces between the sand particles are filled with water. If the sand is shaken, the particles can become temporarily dislodged from each other. The particles are now suspended in the surrounding water instead of enclosing it, and the sand behaves like a liquid.

³ Studies done for East Bay Municipal Utility District indicate that there is 90+ percent chance that liquefaction would occur sometime in the next 30 years at one third of the locations analyzed along their aqueduct where it crosses the southern Delta. (ESA 1992)

⁴ Not all peat soils are the same. Some peat soils in the Delta are fibrous. These soils should attenuate deep ground shaking. Other peat soils are more like muck. These peat soils could amplify deep ground shaking and may themselves liquefy.

There has been little damage in the Delta from earthquakes in the recent past. (DWR 1992) However, during the period when the Delta has existed as we know it today (leveed islands, since the mid-1900's), there have been few earthquakes on faults near the Delta (from San Andreas east). In the eight decades from 1830 to 1910 there were 18 earthquakes of magnitude 6.0 or larger, 8 of magnitude 6.5 or larger, and 3 of magnitude 7.0 or larger, including the 1906 earthquake of 8.3 magnitude. From about 1910, there were no earthquakes of magnitude 6.0 or larger until 1979. Since 1979, there have been four earthquakes of magnitude 6.0 or larger, including the Loma Prieta earthquake (magnitude 7.1, October, 1989). (USGS 1990)

It appears that the region has entered a period of increased earthquake activity. (USGS 1990, CSUH 1992)

The epicenter of the Loma Prieta earthquake was as close to the southern Delta as it was to the Marina District in San Francisco and the Cypress Freeway Structure in Oakland. Significant damage occurred in these Bay Area locations. No such damage occurred in the southern Delta. (DWR 1992)

However, the damage that occurred in the Bay Area during the Loma Prieta earthquake may have been in part the result of peculiar deep rock formations that "bounced" the earthquake energy waves up into the Bay Area. Therefore, the southern Delta may not be less vulnerable to damage from significant ground shaking. (personal communication, W. Lettis W. Lettis and Associates 1992)

If there was failure of a number of levees during an earthquake, flooding of several islands could occur. Such flooding would draw salty water into the Delta unless freshwater flows into the Delta were high at the time. Exports would be interrupted until the salty water could be flushed out. If the damage occurred when reservoir levels were down, valuable stored water supplies could be used up to accomplish this flushing. It could take months to selectively patch up the Delta levees and flush out the salts. (personal communication, J. Cox DWR 1991)

REFERENCES

CSUH--California State University, Hayward. Earthquake Hazards in the Eastern San Francisco Bay Area (Summary of a Public Forum). 1992

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USGS--US Geological Survey. The Next Big Earthquake in the Bay Area May Come Sooner Than You Think (summarizing results of the Working Group on California Earthquake Probabilities, a panel of experts convened by the National Earthquake Prediction Evaluation Council and reporting in July, 1990). undated.